

THE JUNIPER CARPET MOTH
***THERA JUNIPERATA* (L.) (LEP.: GEOMETRIDAE):**
A DECADE OF MONITORING A POPULATION

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THE FLUCTUATIONS in numbers and emergence dates of insects from year to year and throughout each season are a subject of continuing interest. At Park Farm, Kidlington, we have an isolated population of the Juniper Carpet moth *Thera juniperata* on a single bush of a cultivated Juniper *Juniperus communis* var. *compressa*. Further details of this colony are given in a previous paper (Waring 1992). It is possible to count the adult moths directly, at rest on the bush after dark, by examining it with a torch. Counts have been made daily at about 22.00 hours during the adult emergence period, and the results since 1986 are given in Table 1.

These show a number of features which are of more general interest in our understanding of the population dynamics of insects on trees and shrubs.

1. The numbers of moths tends to build gradually to a single peak and then to tail off again during the course of each flight season.
2. The numbers in this example are not varying by several orders of magnitude from year to year or generation to generation, as has been found in some other insect species and in laboratory populations. The peak count has ranged from 80 to 430 individuals and, as the pattern of emergence is similar from year to year, the peak count is likely to be related to the total population size. Food supply is an obvious factor which must be taken into account in population studies. In this system the food supply is a single bush which is not pruned or otherwise interfered with and the total biomass at least is rather constant. On this subject, it is worth mentioning that the larvae tend to feed on the upper shoots and that in 1987 and 1992 they severely defoliated the upper half of the bush (Fig. 1). This was followed by a considerable drop in numbers the following year, in both cases, as can be seen from Table 1. It is quite plausible that the supply of fresh shoots for food became a limiting factor and that larvae died before completing development, or produced less fecund adults, as a result of food shortage in these circumstances. Most years the bush is not defoliated to such an extreme extent. It is worth noting that other species of larvae have been found on the bush occasionally, usually as singletons, such as the Scalloped Hazel *Odontopera bidentata* Cl. and there is a resident population of the Juniper Pug *Eupithecia pusillata* D.&S. which feeds as larvae from April to early June, but the larvae of the Juniper Carpet are by far the most abundant larvae and the defoliation which has occurred has taken place during their period of major growth in August. The photograph of severe defoliation (Fig. 1) was taken on 25 August 1987, which is some time before larvae would normally finish their growth. This emphasises the likelihood that larvae starved in 1987.



Fig. 1. The Juniper bush photographed on 25 August 1987, showing severe defoliation of the upper shoots.

3. The population has not undergone a steady increase or decrease year by year over the decade. There is something of a regular cycle, based on the peak counts. With counts for every year from 1992-1996 we see an alternation of a high count followed by a low one the next year, with 1996 giving a lower count for a third year. The earlier years also show either a two or three year decline followed by an increase, but we cannot be more precise because of the missing years. It will be interesting to see if the peak in 1997 is a high one, as we might predict from past performance. One could speculate on why a low population of adults leads to a much higher number the next year. Interference or competition for a limiting resource could explain the pattern. This could occur in the adult stage as well as among the larvae. The adults walk about over the bush to find mates and lay eggs and high densities of adults may possibly interfere with egg-laying, such that females lay fewer on average.

4. The date at which peak numbers are reached has varied over a range of nearly a fortnight, from 12-24 October, generally occurring in the middle of this period. The date of the first adult sighting has ranged from 4-8 October in the years examined here, but has been as early as the last days of September in some of the previous years. Last sightings have ranged from 23 October (18 October in 1995 was probably premature) to 7 November. In some years the flight season, and presumably emergences, are more protracted than others and this is not necessarily related to the peak count or population size. In 1992 there were 34 days between first and last sightings though the peak count reached only 270 adults, compared with a

peak of 430 adults in 1986 with only about 22 days between the first and last sightings. Possibly the annual variation in population size is less than the peak counts suggest, because of this variation in emergence pattern.

5. There is no consistent trend for the peak numbers to be earlier or later than the previous year over the decade. 1993 was a particularly late year and 1995 was as early as in the late 1980s. However, longer runs of data are desirable for looking for such long-term trends as variations from means, because of the extent of fluctuations from year to year.

Note that, although a number of larvae have been reared from the bush, no parasitoid has yet been reared from them, though this is not to say that parasitoids are not involved in the regulation of this population. There is clearly much scope for more detailed study of this system, should anyone have the time available. Meanwhile, DW will continue to count the adults annually and we hope the moth will be with us on this bush for many years to come.

References

Waring, P., 1992. On the current status of the Juniper Carpet moth *Thera juniperata* Lep.: Geometridae). *Entomologists' Record and Journal of Variation* **104**: 143-148.

Table 1. Juniper Carpet moth counts of adults – Park Farm, Kidlington, Oxon, 1986-1996.

Key: – = no count made. 0 = count took place but no adults seen.

NB. the bush was heavily stripped of needles in 1987 and 1992, mainly upper parts.

Date	1986	1987	1989	1990	1992	1993	1994	1995	1996
Sept									
27	–	–	–	–	–	–	–	–	–
28	–	–	–	–	–	–	–	–	–
29	–	–	–	–	–	–	–	–	–
30	0	–	–	–	–	–	–	–	–
Oct									
1	0	–	–	–	0	–	–	–	–
2	0	–	–	–	–	0	–	–	–
3	0	–	–	–	–	–	–	–	–
4	–	–	–	–	4	–	–	–	–
5	0	–	–	–	–	–	–	–	2
6	–	–	–	–	13	–	–	–	2
7	0	25	–	0	27	–	–	–	6
8	1	62	–	–	48	–	–	28	11
9	46	125	–	6	–	0	32	73	19
10	114	115	–	20	–	–	86	83	34
11	–	240	–	27	110	–	136	87	34
12	196	300	–	49	131	–	175	106	41

Date	1986	1987	1989	1990	1992	1993	1994	1995	1996
Oct. 13	276	240	157	44	162	—	223	54	52
14	416	250	148	80	193	—	332	48	70
15	430	300	140	—	211	—	307	—	60
16	368	c300	91	66	83	10	266	7	75
17	—	270	52	25	189	46	294	—	66
18	249	170	45	19	230	—	—	7	52
19	227	242+	9	19	244	44	—	—	—
20	—	92	—	13	270	—	161	—	—
21	—	72	—	5	214	73	146	—	—
22	204	51	—	3	190	98	—	0	—
23	160	42	1	1	136	—	—	—	—
24	121	24	—	—	117	104	—	—	—
25	—	16	—	—	211	—	—	—	—
26	45	—	—	—	—	84	—	—	3
27	—	—	—	—	85	—	—	—	—
28	13	—	—	—	83	51	—	—	—
29	6	—	—	—	63	32	—	—	—
30	—	2	—	—	38	—	—	—	—
31	0	—	—	—	66	22	7	—	—

Nov.

1	—	—	—	—	39	—	—	—	—
2	0	—	—	—	34	15	—	—	—
3	—	—	—	—	21	—	—	—	—
4	—	—	—	—	17	3	—	—	—
5	—	—	—	—	—	—	—	—	—
6	—	—	—	—	11	—	—	—	—
7	—	—	—	—	3	—	—	—	—
8	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—

Peak Count	430	300	157	80	270	104	332	106	75
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Peak date		Approximate duration of flight period	
1986	15 October	1986	8-29 October c22 days
1987	12, 15, 16 October	1987	7-30 October c24 days
1989	13 October (peak possibly missed)	1989	pre 13-23 October 11+ days
1990	14 October	1990	9-23 October 15 days
1992	20 October	1992	4 October-7 November 34 days
1993	24 October	1993	16 October-4 November 19 days
1994	14 October	1994	9-31 October 22 days
1995	12 October	1995	8-18 October 10 days
1996	16 October (peak possibly missed)	1996	5-26 October c21 days